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DIRECTIONS FOR THE TREATMENT OF THE SAN JOSE SCALE.

By A. L. Quaintance, State Entomologist.

In the present paper will be found full directions for the preparation and use of the three or four best insecticides for the San Jose scale. The presence of the scale in many of the orchards of the State will necessitate much careful spraying during the coming winter and spring, if your orchards are to be saved. The problem has now become an individual one, and each grower has it in his power to keep the scale under control, irrespective of the actions of his neighbors.

The necessity of treating trees infested with scale need hardly be repeated here, for it should be quite generally known, that to neglect such work inevitably means the death of the trees. If your orchards are infested with scale, you have the alternative of taking the matter in hand, or sooner or later to give up fruit growing. Abundant experience in many of the eastern States has shown that the scale may be satisfactorily controlled by the employment of practical remedial measures, but it should be distinctly understood that the work must be thorough, and followed up from year to year. Where the scale has become established, there is but little likelihood of it ever being entirely eradicated, except in very exceptional cases. Consequently, efforts should be expended towards keeping it reduced below an injurious quantity. In a word, we must come to realize that the San Jose scale is with us to stay, and where established, provision must be made for keeping it in subjection as a part of the routine orchard work. As to whether or not it will pay to grow fruit with the added expense of fighting the scale, must be from the nature of the case, an individual question. If a grower is convinced that there is no money to be made in fruit culture with this added expense, he should lose no time in putting his land in other crops, and not allow the orchard to gradually die from the effects of the scale, and prove a source of infestation for the surrounding country.

TREATMENT TO BE EMPLOYED.

The treatment to be employed depends somewhat on the nature of the case. If the trees are badly infested, they should at once be dug up by the roots and burned. Such trees are usually too seriously injured by the scale to make it worth while to attempt to save them. The question of the vitality of the trees should be carefully considered in determining the plan of action. Severe pruning, followed by a thorough spraying, will frequently give satisfactory results, particularly if in addition the trees receive good fertilization and cultivation the following season. Good judgment must be exercised in determining whether it is better to destroy an orchard, or to attempt to save it by the destruction of the scale with sprays. In general, if the infested trees, particularly peaches and plums, have been allowed to go untreated for two or three years, it would probably be wisest to remove them at once.

Where trees are only moderately infested with the scale, it is quite possible to save them by thorough applications of proper spray mixtures. While it is scarcely possible to entirely free trees from scale, after they have become infested, yet, if such trees be thoroughly sprayed at least once each winter or spring, injury from the insect will be comparatively insignificant. Where infested trees have been found here and there in an orchard, the scale is in all probability much more generally distributed than an inspection would ordinarily indicate. Under these circumstances it would be better to spray the entire orchard, and in any case spraying should not be confined to trees seen to be infested, but all those in the immediate neighborhood should be treated. Orchardists should make it a rule to be among their trees as much as possible. Any signs of failing vigor, or unnatural appearance of the bark, should at once call for a close scrutiny. In this way serious loss may frequently be prevented by detecting the presence of injurious insects or diseases as soon as possible after their establishment in the orchard. When you are in doubt as to the nature of the trouble, send specimens at once to this department, and the matter will be given proper attention.

From considerable observation, I am convinced that, as a rule, spraying has not been done with sufficient thoroughness to secure the best results. It should be borne in mind that the scale is not killed unless actually hit with the spray mixture. Special pains should therefore be taken that every part of the tree, from the crown to the topmost branches be treated. In the case of kerosene and crude petroleum there should be a light but uniform coating of the spray over the entire surface of the tree, but drenching is not desirable. When these substances are used in excess, injury to the tree is likely to result from the puddling of the mixture at the crown. Spraying should be done preferably, when there is but little wind movement, and when kerosene is to be used, bright, sunshiny days should be selected as much as possible. The spray nozzle should be set so that the spray will be as fine and mist-like as possible, as a much more even coating can thus be se-

cured. Owing to their position the spray mixture soon runs off of the terminal, and more upright twigs and branches. It thus becomes difficult to destroy the scale in a satisfactory manner. It is very desirable, therefore, that the trees which it is proposed to spray be pruned back somewhat at some convenient time before the spray is applied. The "heading-in" will be beneficial to the tree, and a much more complete destruction of the scale will be secured.

When rather high trees are to be treated an extension pole is necessary, by which means the nozzle may be elevated sufficiently high to spray the higher parts of the tree. In some cases some form of scaffolding, rigged up on the wagon, may be necessary. The person or persons using the nozzles, by standing on this, and by the use of an extension pole, will likely be able to effectively treat the topmost branches of the highest orchard trees.

Much inferior work has resulted also from the fact that the hose leading from the spray pump has not been of sufficient length. For a barrel pump, the hose should be at least twenty feet long, or, better, twenty-five. This will enable the sprayer to get quite around an average orchard tree, with the wagon standing between the rows, and finish the tree before leaving it. The work is thus likely to be much more thorough than if but one side of a tree is sprayed at a time, as is almost necessary with a ten-foot hose. A barrel pump is much the most satisfactory size for orchard use, as it is possible to secure the necessary force for thorough work. An economical arrangement is to supply the pump with two twenty-five foot lengths of hose, so that two rows may be treated at once. This will require three men, one for each hose, and one to do the pumping and driving. As the most suitable days for work of this kind are comparatively few during winter and spring, the arrangements should be such that the work may be done as rapidly as possible when favorable weather prevails.

Spray Mixtures to be Employed.

For a summer spray we have found kerosene emulsion, on the whole, quite satisfactory. This should be made up as follows:

Water	5 gallons.
Ordinary hard soap.....	1½ pounds.
Kerosene (150 degrees)	10 gallons.

The water should be heated to the boiling point, and the soap sliced and thoroughly dissolved in it. Pour the hot water into the spray pump barrel, and at once add the ten gallons of kerosene. Thoroughly emulsify by pumping the mixture back into itself for ten or twelve minutes, moving the nozzle around all the while. Dilute with thirty-five gallons of water, making fifty in all, or a fifty-gallon barrel full. This makes a twenty per cent. kerosene emulsion, and if applied on bright days will do but little, if any, injury to the foliage or fruit, and will kill a considerable per cent. of the scale. Where the trees are badly infested, and no treatment was given during the preceding winter or spring, one or more summer treatments should certainly be

made. Some have used fifteen or twenty per cent. treatment of kerosene in mechanical mixture with water, using the "kerowater" pump without injurious results to the tree. Where experience has shown that this may be safely done, the necessity of making the emulsion is thus obviated. In localities where the careful use of kerosene has resulted in injury to the trees, it should not be used at any time. Whale oil soap, at the rate of one pound to two gallons of water, may be used as a summer wash instead. This will kill the young crawling lice, and many that have but recently settled. But few of the mature scales, however, will be killed, and repeated applications should be made. The effort, however, should be to treat all infested trees during their dormant period, as at this time the wash may be applied much stronger, and the absence of foliage allows of much more satisfactory work.

The following insecticides are recommended for winter or spring treatment when the trees are in a practically dormant condition:

(1).—*Lime, Sulphur and Salt Wash.*—As a result of considerable experimentation with this wash in Maryland, we are recommending it with much confidence to the orchardist of the State, as an efficient winter or early spring treatment for the San Jose scale. The effectiveness of the wash in California has long been admitted, but its use in the East, it had been supposed, would be much less effective on account of our more rainy climate. The wash, however, has proven to be very satisfactory in Oregon, where the rain-fall is approximately the same as in the East. Results of extended experiments in Illinois show that the wash is very effective in that State, it having been estimated by careful count on many different trees that from 99 to 100 per cent. of the scale had been killed by its thorough application to the infested trees. Our own experiments in Maryland show it to be equally effective here, though the final insecticidal effect of the wash may not be apparent until rather late in the summer. The wash, in addition to its effect on the old scales, seems also to remain on the tree in sufficient strength to cause the death of a large part of the young lice developing from the adults, which failed to succumb to the treatment. The wash should be applied only when the trees are dormant. If applied in the spring, just as the buds show signs of swelling, the maximum of effectiveness would doubtless be reached. Its use at this time would also be of much value in preventing injury from peach leaf curl. The cost per gallon of spray mixture should not exceed one and one-half cents, it being the cheapest treatment now at hand, considered from the standpoint of its efficiency. The wash can be readily made in a large iron hog scalding, feed cooker or similar vessel. Where a steam engine is at hand, it may be readily prepared in barrels by cooking with steam. Before pouring the wash in the spray barrel it should be carefully strained to remove any small lumps of lime, which might interfere with the proper action of the spray pump.

Formula and Directions.

Unslacked lime	40 pounds.
Sulphur	20 pounds.
Stock salt	15 pounds.
Water, to make	60 gallons.

Directions.—Place ten pounds of lime and twenty pounds of sulphur in a boiler with twenty gallons of water, and boil over a brisk fire for not less than one hour and a-half, or until the sulphur is thoroughly dissolved. When this takes place the mixture will be of an amber color. Next place in a cask thirty pounds of unslacked lime, pouring over it enough hot water to thoroughly slack it; and while it is boiling add the fifteen pounds of salt. When this is dissolved, add to the lime and sulphur in the boiler, and cook for half an hour longer, when the necessary amount of hot water to make the sixty gallons should be added.

(2).—*Whale Oil Soap*.—This is a most satisfactory substance to use against the San Jose scale. Its cost has doubtless prevented its more general adoption, but considered from the standpoint of its efficiency this objection loses much of its force. Where it is necessary to have the spraying done by ordinary farm labor, the use of whale oil soap is frequently to be recommended, since the danger of careless use of kerosene is thus obviated. On pear and apple trees the soap solution should be used at the rate of two pounds to each gallon of water, and it may be applied at any time during the winter. For peach and plum, however, it should be used at the rate of one and one-half pounds of soap to the gallon of water, and its application should not be made until shortly before the fruit buds begin to swell in the spring. Mid-winter or earlier applications of whale oil soap to peach and plum trees may have the effect of preventing the development of the fruit buds, and these are likely to be injured if the soap is used stronger than indicated. There are several brands of soap on the market, but we have found Good's Potash Whale Oil Soap No. 3, manufactured by James Good, 939 and 941 N. Front street, Philadelphia, Pa., to be most satisfactory, dissolving sufficiently to be readily sprayed while warm, at the rate of two pounds to the gallon. In any event a potash soap should be insisted on, as the soda soaps are likely to become more or less solidified when cold, and hence cannot be used in the spray pump. Any ordinary spray pump will be satisfactory in applying the whale oil soap. Good's Potash Whale Oil Soap may be purchased of the manufacturer at from three to five cents per pound, depending on the quantity ordered.

(3).—*Kerosene*.—Ordinary illuminating or coal oil, in twenty per cent. mechanical mixture with water, is being quite largely used at the present time against the scale. It has proven satisfactory in Western Maryland, on the whole, and at the present time is probably the main reliance. From several localities on the Eastern Shore, and the tide-water section generally, there has been complaint of severe injury to the trees treated. A difference in the humidity of the air may be respon-

sible in part for this difference in its effects. Kerosene, therefore, should be used with considerable caution, if at all, in this territory, and the lime, sulphur and salt wash, or whale oil soap would prove safe substitutes. One of the serious difficulties in the use of all Kerowater pumps thus far has been their unreliability; that is, many of the pumps fail to discharge a given per cent. of oil. The per cent. of oil may be greater or less than indicated by the "set," and hence the trees may be injured by an excessive application, or, on the other hand, the per cent. may not be sufficiently high to be effective against the scale. In using the "Kerowater," therefore, it should be tested from time to time, by spraying some of the mixture in an ordinary cylindrical fruit jar. After allowing the jar to stand a while the oil will have separated to the top, and the per cent. may be readily determined by the use of a rule.

SPRAY PUMPS.

There are now very many spray pumps on the market, ranging from bucket pumps to barrel sprayers, and larger. For spraying low trees, vines and shrubs on a small scale, a bucket or knapsack pump will be satisfactory. These may be purchased with or without kerosene attachments, as desired. Where ordinary orchard trees are to be treated, a barrel sprayer becomes necessary for effective work. These also may be purchased with or without the kerosene attachment. Among the most satisfactory barrel pumps for the application of the lime, sulphur and salt wash, whale oil soap or Bordeaux mixture, should be mentioned the "Pomona," manufactured by the Goulds Mfg. Co., Seneca Falls, N. Y.; the "Century" and "Peerless," manufactured by the Deming Co., Salem, Ohio, and the "Eclipse," manufactured by Morrill & Morley, Benton Harbor, Mich. The latter pump, in comparison with its cost, is most excellent.

Of the barrel sprayers for making the mechanical mixture of kerosene and water, the Goulds "Kerowater" is much more reliable than any we have tested. The Griffith & Turner Co., of Baltimore, represent the Gould Mfg. Co., in this State, and their pumps can be purchased of this firm. In ordering a pump it should be specified that a twenty or twenty-five foot hose is wanted, fitted with either the Deming or Gould Vermorel Nozzle. Prospective purchasers of spray pumps should secure the catalogue of the above firms, and order the pump that will meet their needs. Bear in mind that it has now become necessary to spray to secure good fruit, not only on account of the San Jose scale, but to prevent injury from various other species of injurious insects and plant diseases. To the wide-awake fruit grower a spray pump has become an absolute necessity.



